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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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MODERN WELDING.

Welding and Cutting Metals by Aid of Gases or Electricity. By Dr. L. A. Groth. Pp. xvi+281. (London: A. Constable and Co., Ltd., 1909.) Price 10*s.* 6*d.* net.

THE art of welding iron is very old, probably as old as the production of the metal from its ores. Previous to the nineteenth century the art of forging and welding iron reached a high stage of development. Then came the cast-iron period, which for a time usurped the place of the forged metal. But during the last half-century, owing to improved and less costly methods of production and the introduction of machines which can make forgings of a size far greater than can be worked by a smith, new methods of welding have become necessary. Welding of the metals has kept pace with the improvements in metallurgy, and a great part of it is now carried out by fusion; consequently, joins of almost any thickness can now be made, whereas by the method of hand hammering the size and thickness of the joins was very limited.

The book before us deals with the welding of metals mainly by the newer methods which have been made possible by the advance in electrical science and by the use of reducing flames of high temperature, such as hydrogen and acetylene. But not only can high-temperature flames be employed for welding; they can also, by altering the conditions, be used for cutting thick plates of metal. Whereas, however, the welding is carried out by means of flames containing an excess of a reducing gas, the cutting is done by means of flames rich in oxygen.

The book commences with a short introduction explaining the nature of a weld. Chapter ii. is headed "Gases and Sources for their Generation." One hardly knows what to make of this chapter; if it is written for the novice it is useless, if written for the chemist unnecessary. We are told, in the first place, "it has been known for ages that matter is capable of existing in three physical states: the solid state, the liquid state and the gaseous state."

Further on there is an historical account of the manufacture of calcium carbide and of the preparation of acetylene. It is a pity that this part of the book is not written in a manner to help the welder or cutter, and is not always accurate. What, for example, does this mean?

(Hydrogen) "is usually prepared by the action of zinc or iron on a solution of hydrochloric or sulphuric acid. All metals which readily decompose water when heated readily furnish hydrogen on a similar treatment. Many other acids may be used, *but none cut more readily*. In all cases the action consists in the displacement of the hydrogen . . . and if the acid is not one which can enter into reaction with the displaced *nitrogen*, the latter is evolved as a gas."

Poor novice! Again, hydrogen was not liquefied by Cailletet on December 30, 1877.

From chapter iii. and onward the book is interesting and instructive. Welding and the different systems employed are described—thus autogenous, or the union of the metals by direct fusion; under this we get alumino-thermic processes, electric welding, welding with compressed gases. Heterogeneous, in which a foreign metal or alloy is employed, which has a lower melting point than the metals to be joined.

The welding of aluminium, which is similar to lead burning, is described, and illustrations are given to show that, as a rule, the tensile strength of a welded bar is greatest at the weld, or, at any rate, breaking does not take place at this position. The alumino-thermic process is well described, and two interesting diagrams showing the mending of cracks in the stern frame of a steamer are shown.

A considerable amount of space is devoted to electric welding, which has been found so useful in the welding of pipes and tubes; very interesting illustrations showing the joining of pipes to form T's and other unions are given.

Chapter iv. deals with blow-pipes of various design which are used for different purposes. We are not particularly impressed with the insertion of advertising letters in chapter v. This chapter deals with the

welding of sheet-iron, and various methods are described. But surely it should not be necessary to print letters from the Public Works Department of Perth, W. Australia, and from other bodies, writing in appreciative terms of a certain process which, as we are not advertising it, we need not mention. To our mind, in book-writing the author should use his own judgment, which may or may not be influenced by letters of recommendation, but it says little for his analytical skill if he finds it necessary to print the letters.

The part of the book dealing with the welding and cutting of metals is extremely interesting, and illustrates the great advance which has recently been made in this direction. In all autogenous processes a reducing flame which prevents the formation of oxides is a *sine qua non*; but when a flame is to be used for cutting purposes the reverse is the case. Most metals, when heated to a sufficiently high temperature, will burn in oxygen. This property is made use of in cutting steel, for example. An oxy-hydrogen flame is caused to impinge upon the metal, and at the same time an auxiliary blow-pipe directs oxygen gas upon the heated surface; immediate combustion ensues. The stream of oxygen is sufficiently powerful to drive away the oxide as it is formed, and the cutting progresses very rapidly. For example, an armour plate 6·3 inches thick was thus cut to a length of 1 metre in ten minutes. At Bremen a similar process has been employed for cutting up and scraping ships.

The book is suggestive, useful, and will, we hope, enjoy a large circulation in spite of the few errors here pointed out, and when the second edition is being prepared we trust the author will take notice of our friendly criticism. F. M. P.

PROBLEMS IN NUTRITION.

Volksernährungsfragen, and *Kraft und Stoff im Haushalte der Natur*. By Prof. Max Rubner. Pp. iv+143 and 181 respectively. (Leipzig: Academische Verlagsgesellschaft, 1908, 1909.)

THESE two little books contain three useful and readable essays on those nutritional problems to which Prof. Max Rubner has directed most of his research work. The first of the above-mentioned books contains two of these, and they treat of the minimum protein requirement of man and of diet of the poor respectively. The first question has within recent years been brought prominently before the scientific world, as well as the public at large, by the work of Chittenden and others, who argue from their experiments that, because they themselves have been able for limited periods to maintain their health and equilibrium on an amount of protein which is far below the usually accepted Voit minimum, therefore all men should permanently reduce their intake of protein to the same low level. Those who believe that the minimum is also the optimum would do well to read and consider carefully the Berlin professor's judicial commentary on their views.

What most strikes the reader is the extraordinary complexity of the problem. One factor, however, is absent, and that is the effect of work and rest, for this causes practically no effect on the metabolism of protein matter; but the question is sufficiently complex without this. There is between different people an enormous variation in what one may term their metabolic habits, so that any hard and fast rule is impossible. The mere body weight is not an important element, although, naturally, the heavier a man the more protein will he require. If this were all, it would be easy to adapt the dosage to the body weight; but the difference is deeper than this; to mention one point only, it is shown that, as a rule, the thin person requires more protein to maintain nitrogenous equilibrium than the corpulent. It must have been a matter of common observation that the stoutest people are not the biggest eaters. Another complicating factor is what one eats with the protein, and also the kind of protein one ingests. It is shown that on a potato diet, for example, the minimum necessary to maintain nitrogenous equilibrium is less than with any other of the diets adopted. We have further to take into account the presence, in most foods, of nitrogenous substances which are not protein, but which, nevertheless, have to be reckoned with.

The second essay, on the diet of the poor (agricultural labourers and the like), emphasises very clearly one reason why a low protein intake brings the consumer dangerously near to the margin. It is shown beyond question that such a diet renders people much more prone to take infectious diseases, and there is a general lowering of the powers of resistance. Considering that the bulk of the population consists of those who are not well to do, this becomes a matter of national importance, and it is the duty of the State to interfere. Prof. Rubner appears to think that legislative measures should be adopted. We can see, however, that the difficulty of legislating on such a matter is very great; but at least the people should be educated on the question of feeding rationally, especially where children are concerned. Anyone with any experience of hospital patients knows that ignorance, in addition to poverty, is at the bottom of most of the conditions of malnutrition which meet us at every turn. Ignorance, moreover, is not confined to the poor in regard to this most important question.

The third essay, which occupies the second volume, is a summary of Prof. Rubner's work on nutrition generally; it is written in a more popular manner than most of his publications, and a distinct philosophical vein runs through it. The chemical events which occur in the living body fall mainly into two categories—(1) those due to the activity of enzymes; in these there is but little transformation of energy; and (2) those which may roughly be described as combustion, and from which the energy of living and doing is derived. It is the second class of chemical changes to which Prof. Rubner has mainly directed his attention, and it is to him, in particular, that we owe the experimental proof that the law of conservation of energy applies to the living cell as well as to the world of inorganic matter. The law of the conservation of energy is so universal that one might, perhaps, have assumed it would hold for living as well as for lifeless material. But the scientific mind